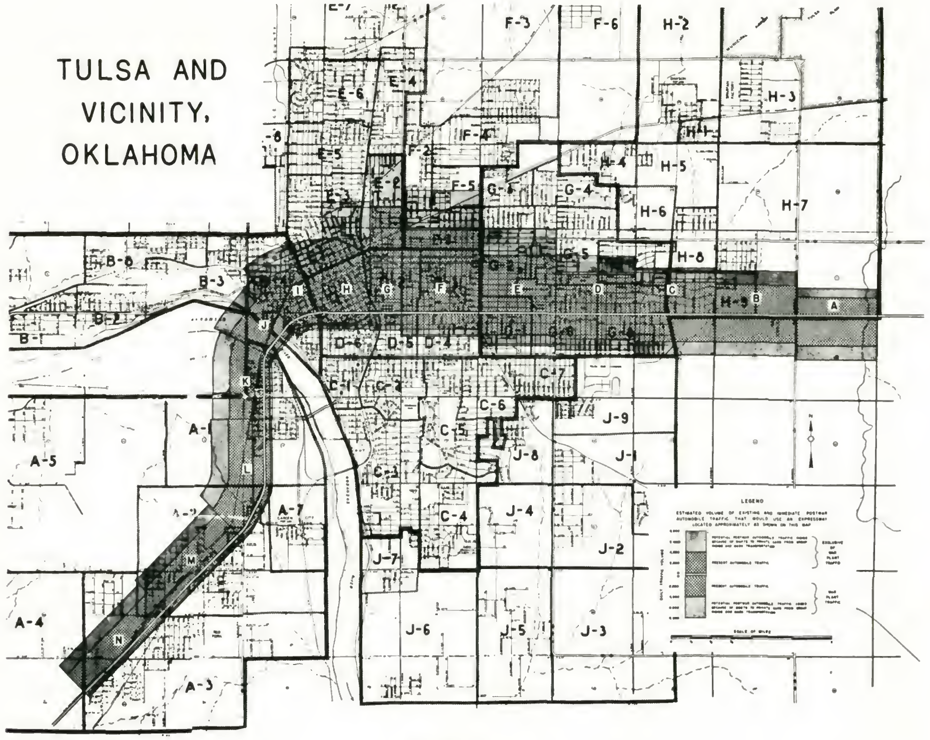

Figure 19

carry. Figure 19 shows the results of this analysis.

The assumed expressway was divided into sections not more than about a mile long, each section terminating at an important cross street. From the zone to zone traffic flow tables, traffic was assigned to different sections of the expressway, if time would be saved by using the facility. In making the calculations, speeds on the expressway were assumed to be three times as great as those on existing streets in the congested area and twice as great in outlying areas.

Existing automobile traffic going to and from war plants with an uncertain future is shown separately by the dark band just below the centerline so that the extent to which the usage of any portion of the proposed facility would be affected by closing the plants or greatly curtailing production could be determined. It will be noted that the war plant traffic is large near the east city limit, but relatively small through the downtown area.

All other existing automobile traffic which would use each section of the facility is shown by the band just above the centerline. This traffic is relatively small near the city limits and reaches a maximum near the center of the city. It is much more stable in character than that to the war plants.

The band at the bottom shows potential automobile traffic to and from the war plants due to driving by persons now traveling as passengers in busses, streetcars or automobiles, in case the plants should remain in full production and restrictions on automobiles, parts and fuel should be lifted. The band at the top shows similarly all other potential automobile traffic from such shifts. As previously explained, this was calculated on the assumption that an automobile trip would result in 70 per cent of the cases where a passenger said he would have driven if it had not been for the restrictions.

Future traffic growth, over a period of 20 years or more, remains to be estimated, but with this exception, the diagram and the data on which it is based give all of the information needed to compare this route with any other as regards traffic service, to determine the design volumes for different sections and to determine the needed locations and capacities of the access roads. A proper analysis of the data being collected in the urban traffic studies under way will, therefore, supply all of the information concerning traffic requirements needed as a basis for planning the post-war urban program.

The Legibility of Highway Signs

By HARRY E. NEAL, Ohio

BEFORE the first U. S. Manual of Uniform Traffic Control Devices was published in 1927, the Joint Board on Interstate Highways, which was created to designate the system of U. S. highways and to develop a system of signs and markers for them, gave very careful study to the design of the lettering to be used on signs. At that time the best signs available were made of embossed metal and the specifications were naturally built around this type of sign. Leading sign manufacturers were consulted by the joint board and the alphabets for sign lettering were designed to facilitate the cutting of the steel dies used in the embossing presses. These alphabets were made up of straight lines and angles. They were good-looking letters and they were universally adopted. The predominance of parallel vertical lines, however, especially where it was necessary to space the letters closely, did not make for easy legibility. Many have felt that something nearer to a normal freehand lettering, with a natural rounding of the curved strokes, would be more open and legible.

The 1934 Manual on Uniform Traffic Control Devices suggested that "Rounded corners of letters and figures are desirable when dies are not involved." In 1939 the word "recommended" was substituted for "desirable." Finally in 1942 the Joint Committee on Uniform Traffic Control Devices went all the way, specifying that "rounded" letters should be used and requesting the Public Roads Administration to prepare a new set of standard alphabets in the rounded style.

The designing of good looking, legible alphabets is not as simple as it might seem. It was found that it is not sufficient simply to take the old alphabets and merely use the longest possible radii at all rounded corners. Such treatment only results in awkward mechanical letters. In designing the new rounded letters, the aim of the designers was to make clear, pleasing letters and numerals, consistent in style throughout the entire range of letter widths and easy to repro-

duce on the drawing board. In some cases, especially among the numerals, many experimental designs were tried before a well-proportioned, balanced character was achieved.

To justify the cost of the scrapping of thousands of dollars worth of dies, which will be made obsolete by the adoption of the new letter designs and their replacement, even as a post-war project, to say nothing of the cost of necessary new silk screen stencils, it was necessary to determine if there was any evidence in support of the assumed superiority of the rounded letters. No previous research could be discovered that gave any help. It is known that the Army Engineer Board made tests before standardizing rounded letters for military traffic signs, but no information is available as to how complete or conclusive these tests were.

To determine the relative legibility of block and rounded letters and to investigate other factors affecting legibility, a series of investigations was made during the past year by the Ohio Department of Highways in cooperation with the U. S. Public Roads Administration, on behalf of the Joint Committee on Uniform Traffic Control Devices. The research was directed to the two principal questions of letter style and means of reflectorizing. To a lesser extent, letter spacing and stroke width were explored. Although the studies, within their limited field, were as complete as any known of, it must be recognized that their scope was narrow, and that they raised perhaps more questions than they answered.

Before making any comparisons of the old and new letters, it seemed desirable to investigate some details of the new designs, particularly as to whether the stroke widths selected were best for legibility. Twelve typical letters and numerals in each of the six alphabets were selected, and each was made up in three stroke widths, these being, respectively, the "standard" used in the original designs and one-eighth inch above and one-eighth inch below this value. (An exception was made in the case of

Figure 1

Figure 2

the already narrow series A alphabet, in which the narrowest stroke width was not tried.)

The test letters and numerals, in black India ink on white Bristol board, were assembled into panels of 24 characters each which were set up one at a time at the end of a 700-foot course in a field adjacent to the Ohio Department of Highways sign shop in Columbus. The characters were arranged at random and wide-spaced so that they could read individually. The observers were given recording forms and were instructed to walk toward the panels from the 700-foot station, stopping at each of a number of marked stations to write down all the characters they could identify at each station.

However, severe weather in the month of January when this was done made it impractical to continue the outside observations. Light conditions were also extremely variable. To avoid these complications it was decided to move indoors where the tests could be made under controlled lighting conditions.

The panels were photographed down to produce letters exactly 1½ inches in height and the tests were started over again in a National Guard Armory. Here it was possible to mount a panel, together with suitable lighting, on a wheeled carriage and move it toward the observers, of whom 8 or 10 could sit comfortably at a table in a heated room. Reading distances were, of course, reduced in proportion to the scaling down of letter size, so that the indoor starting distance of 150 feet was equivalent to 800 feet for the original eight-inch letters. Distance readings were recorded at 4.69-foot intervals (the equivalent of 25 feet).

About 50 observers read each panel, but not all panels were read by the same observers. In the analysis of the data, therefore, comparisons of the variants of any one letter or numeral were made only between readings by the same individuals. This reduced the sample for comparison in each case to about 30.

Figure 3

Figure 4

The analysis of the data yielded no conclusive evidence that stroke width, within the narrow range tested, had any effect on legibility. While marked differences in legibility appeared for the different stroke widths of individual letters and numerals, the differences were largely canceled out when all 12 characters in each alphabet were averaged together. It was assumed, of course, that a uniform stroke width must be used for each alphabet regardless of preferences for individual letters.

It is possible that the test did not include a sufficient variation in stroke width to give a final answer to the question. Experimental letters with greater extremes in stroke width had been set up, but some of these were not very pleasing in appearance. Eye appeal, of course, should give way to utility in a case of this sort, but it is not believed that a further increase or decrease in stroke width could have changed the findings significantly. It was the conclusion from these tests that in the case of separate letters or numerals, not closely spaced, the outline shape of the character and its distribution of black and white areas are more important to recognition than are small differences in stroke width. The possible relationship of stroke width to letter spacing, or to the reflectorizing of letters or background, is, of course, another question—or several questions.

In the light of the results of testing the legibility of individual letters, it seemed doubtful whether the two styles of letters would show significant differences when viewed individually. Inasmuch as these tests indicated that the identification of a letter is more by general pattern than by small details, a rounded letter standing alone may be hardly more legible than the same letter in block design. On the other hand, the rounding of letters can greatly change the pattern created by two or more adjacent letters, and single letters are not likely to be used alone on signs.

The next series of investigations, therefore, used actual test signs, made to order in the sign shop and erected along a straight stretch of highway to be read by observers in moving cars.

Observers were seated as passengers in the front seats of cars being driven past the signs at a speed of 25 miles per hour. The possibility of having the observers drive themselves was considered, but despite some sacrifice of realism, it was decided that by relieving the observers from the responsibility of driving and thus minimizing the distractions of traffic the results would be more consistent for the comparisons to be made.

A recorder rode in each car to note on a prepared form the distance from each sign at which the observer correctly read the legend aloud. To make it possible for the recorder to estimate distances accurately, stakes were driven into the road shoulder at 50-foot intervals at the approach to each sign, those at the 100-foot points being numbered with small reflectorized panels, for day and night visibility.

The signs were mounted perpendicular to the road centerline, 3½ feet above the pavement level and 6 feet outside the pavement edge. All signs were made up with black letters on a white reflectorized background, on boards 6 by 40 inches in size.

The signs of the first series tested were designed to compare the block and the rounded letters, in the series C alphabet, and to explore the effect of different letter spacings. Eighteen signs were made, with 4-inch letters, using nine imaginary geographic place names six to eight letters in length. Each legend appeared once in block and once in rounded letters.

Three different letter spacings were used. The "normal" spacing was about one and one-half times stroke width for parallel vertical strokes in the block lettering, with variations for other types of adjacent strokes. The "close" spacing was about half and the "wide" spacing about twice the "normal." Due to differences in the alphabets, it was not prac-

Figure 5

Figure 6

Figure 7

ticable to use identical spacing for the block and rounded letters, but in each case the over-all word length was the same for the two alphabets. To discourage guessing, the legends were chosen in groups of three, having the same initial and final letters.

Forty-five observers were driven over the test course by day, and 36 by night. To eliminate the effect of easier recognition at the second reading of each legend, the 18 signs were shifted into exactly reversed order midway of the tests. A straight arithmetic average of all the reading distances recorded for each sign was taken as a measure of its legibility.

Although the series C alphabet is not wide enough to permit a great amount of rounding, and although only a part of each legend was in "roundable" letters, the data showed a slight but fairly consistent advantage for the new alphabet. As might have been expected, the advantage of the rounded letters was greatest, 4.3 per cent, in the closest spacing. In the "normal" spacing the rounded letters were 2.2 per cent better, and in the "wide" spacing legibility was exactly equal. The daylight data are summarized in Table 2.

The apparent advantage of rounded over block letters practically disappeared at night, the legibility distances being only 0.9, 0.0, and 1.8 per cent greater in the close, normal, and wide spacings, respectively. The better showing of rounded letters in wide spacing here does not seem consistent with the other data.

Because different legends were used in the three sign groups having different letter spacings, it would not be proper to compare these groups to draw conclusions as to the effect of letter spacing. Therefore, in addition to the 18 signs above described, there were erected on the sign course, at the same time, 12 other signs which used the same legends and alphabets as were used for the close spaced signs of the first group, but in normal and wide spacings.

The wide spacing of block letters proved to be 12.2 per cent better than normal spacing of block letters and with rounded letters wide spacing was 9.4 per cent better than normal spacing. Again, this seems to confirm what might have been predicted. The rounded letters apparently do not tend to run together as much as the block letters when closely spaced.

The results at night were less consistent, with the percentage differences much smaller.

This spacing study indicates that wider spacing than we have been using will apparently increase legibility. The limited tests are not conclusive as to the "optimum" spacing. An interesting question is raised, as yet unexplored, whether in any given case a narrow letter with wide spacing or a wider letter with close spacing should be used.

Figure 8

The next series of tests was essentially like that preceding, being designed to extend the investigation to include the series B, D, and E alphabets. A new lot of 52 signs was made up with a separate and independent group of legends for each variable, so that no single legend had to be read more than three times.

As previously, each comparison was made to depend on a group of three legends in signs identical except as to the variable under consideration. Eight-letter geographic names were used throughout. All signs were in 4-inch black lettering on a plain painted white background and all observations were made by daylight. Fifty-two observers participated in the test. As before, the signs were rearranged in reverse order after about half the observers had gone over the course.

The first comparison made was between the block and rounded lettering in the series B, D, and E alphabets, using "normal" letter spacing only. The series A and F letters are so rarely used in highway signs that it was not thought necessary to include them, at least for the present.

Although there were some apparent inconsistencies in the data, the evidence was quite similar to that previously found. The rounded letters had 6.3 per cent greater legibility than block letters in the series B alphabet. In series D the rounded letters were better by 1.0 per cent, and in series E by 6.7 per cent. The rounded series B letters would not have shown up quite so well, nor the series D quite so poorly, had not the values for one of the legends in each group been noticeably out of line with the rest.

In the investigation of letter spacing, only the series B and E alphabets were used, in block and rounded letters. Again, the "normal" spacing was approximately one and one-half times stroke width for parallel vertical strokes, with the close and wide spacing about one-half and two times, respectively, the "normal" value.

In the series B block letters the close spacing was 11.8 per cent poorer than the normal spacing, but with rounded letters the close spacing was only 1.4 per cent poorer than the normal spacing. With block letters the wide spacing was 7.2 per cent better, but with rounded letters the wide spacing was 12 per cent better than the normal spacing.

In the E series block letters the close spacing was 9.2 per cent poorer, and the rounded letter 5.6 per cent poorer than the normal spacing. The wide spacing for block letters was 4.4 per cent better

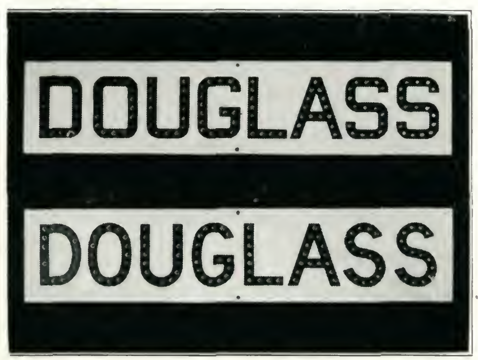

Figure 9

than the normal spacing while the rounded letters were 8.2 per cent better.

While the close spacing caused greater loss of legibility for the block letters, which seems logical, the rounded letters in both series gained more than the block letters when the spacing was increased. This was unexpected and not quite consistent with the earlier findings for the series C letters.

It is significant that in the entire lot of 12 legends, each tested in three letter spacing, there was only one instance where the close spacing was better than the normal and one where it was equal. In all 12 cases, the wide spacing was better than the normal.

Figure 10

These tests seem to have established the fact that rounded letters are generally more legible than block letters. The advantage is not very great, percentagewise, but it is there. Another technique of testing might, of course, have yielded quite different percentage values.

It should be noted here that these tests so far have covered only letters. The proposed new numerals are quite radically different from the old numerals and plans are now under way for legibility tests on the numerals at an early date.

As to letter spacing, the evidence is clear that legibility is enhanced by wider spacing than has been commonly used.

Figure 11

The tests did not go far enough to fix rules for spacing, but since our widest spacing was about all that a sign designer would be likely to consider from the standpoint of appearance, it seems hardly necessary to try still wider spreading out.

Having reached a resting point—obviously not a quitting point—in the testing of letter design and spacing, it was felt that the next step should be an exploration of the problem of reflectorizing in relation to sign design. Glass reflecting buttons of various types have been used for a good many years. More recently, plastic buttons have been developed, using different optical design, but of similar effect and appearance. During the past few years reflecting coatings containing minute glass spheres or beads partially embedded in a suitable pigmented binder,

Figure 12

have found increasing application in highway signs.

A good many questions have arisen in connection with the use of reflecting elements. For example, in a letter of given size and stroke width, what are the best size and arrangement for reflecting buttons, and how are these related to optical brilliance? When reflecting coatings are used as the background, should the stroke width of the letters be increased to compensate for the apparent loss of stroke width due to "irradiation" that makes the illuminated area seemingly expand into the dark area? Are reflecting letters on a black background superior to black letters on a reflecting white background?

Tests were designed (1) to compare black letters on a white reflectorized coating background; with reflectorized coating letters on a black background; and with reflector button letters; (2) to discover the effect of widening the stroke width of black letters on a reflectorized background; and (3) to test a theory that rounded letters are better adapted to reflectorizing with reflector buttons, due to greater freedom of arrangement.

For the first investigation, a group of three legends was made up with 4-inch series E rounded letters in black on white reflectorized coating, and in white reflectorized coating letters on a black background. Another group of signs with 8-inch rounded series D letters was made up in similar fashion and also with ½-inch glass buttons in black letters on a painted white background.

For the tests of stroke width in relation to a reflectorized background, a group of signs was prepared using 4-inch series D rounded letters in three stroke widths, ⅝-inch (standard), ¾-inch, and ⅞-inch. The same specifications were used in still another group of signs, except that 8-inch letters were used and stroke widths were increased by ¼-inch steps.

A final group of signs was designed in 8-inch series D letters fitted with ½-inch reflector buttons, in both block and rounded styles.

There were altogether 39 signs in the lot, most of them with 8-inch lettering. Thirty-two observers were taken over this course by day, and the same number by night.

The principal discovery in these tests was quite unorthodox. The 4-inch white reflectorized coating letters on a black background proved to be 20.1 per cent more legible by night than were the black letters on a white reflectorized background. In the 8-inch size the reflecting letters were 12.7 per cent better. Furthermore, the same two groups of signs showed superior daylight legibility by 3.6 per cent and 3.7 per cent, respectively.

The corresponding reflecting button signs (*made only in* 8-inch *size*) were 5.9 per cent poorer than the black on white reflectorized background signs by night, and 1.4 per cent poorer by day.

It should be pointed out that the glass button signs were probably at a disadvantage because the painted background had a rather high gloss which resulted in highlights due to specular or mirror reflection. The high lights from the background undoubtedly affected adversely the legibility of the button signs.

It should be emphasized that these tests were for legibility only. There was general agreement among all participants that in the daytime the black background signs were difficult to locate, especially if they happened to be in a shadow. Once spotted, however, they were apparently quite legible. In other words, legibility was good, but "target value" was poor. Since the objective was to measure legibility only, the recorders were careful to warn the observers when to watch for signs, so that the results have no relation to the important element of attention-getting power. It seems evident that, if black backgrounds are used, some sort of light colored border or additional background will be needed to increase the target value of the signs for daylight visibility. Experimental signs with various types of borders have been made to study in the near future.

The relatively poor showing of reflecting button signs was probably due, at least in part, to poor design as well as to the high lights from the background. Logically, the best design for each type of reflecting material should have been determined before trying to compare materials.

A different letter stroke width for the two types of reflectorized coating signs (i. e., white on black vs. black on white) might make the comparison less unfavorable to the present standard of black legend on a white background. This question was at least partially answered in the next phase of the investigation, that of stroke width for signs having a reflectorized coating background.

As previously stated, 4-inch and 8-inch series D letters were used in three stroke widths. It was found that by night the 4-inch signs gained little, if anything, from widening the stroke. By day, both of the wider strokes were inferior.

The 8-inch signs, however, by night, were 6.4 per cent better in the first oversize width and 7.8 per cent in the second. By day, they showed 4.4 per cent gain in both oversizes.

At present, there is no satisfactory explanation as to why these two sets of signs behaved so differently. The only difference in design, other than letter height, was an unintentional difference in letter spacing. Apparently due to inadequate length of the larger signboards, the 8-inch signs were compressed so that spacing was barely more than standard stroke width, i. e., below what we have elsewhere regarded as "normal." The 4-inch letters had, proportionately, at least twice as much space between letters.

Stroke width definitely affects legibility, but it is somehow tied in with letter size and spacing. This is perhaps why the first tests on individual letters showed no apparent relationship between stroke width and legibility. Further research will be necessary to clear up some of these questions. Meanwhile, it may be noted that the increase in stroke width caused no such gain in legibility as did the reversing of the black and white color scheme for night effectiveness. Widening the 8-inch letters accomplished just a little more than the color reversal for daytime legibility.

TABLE 1
Comparison of Average Legibility of Alphabets with Different Stroke Widths Before Adjusting Values for Effect of Position in Panel

Alphabet Series	Stroke Width: Standard — Legibility Distance	Narrow — Legibility Distance	Narrow — Per Cent of Standard	Wide — Legibility Distance	Wide — Per Cent of Standard
A	462	...	.....	461	99.8
B	475	487	102.5	471	99.2
C	569	579	101.8	577	101.4
D	611	595	97.4	606	99.2
E	678	675	99.6	677	99.9
F	696	701	100.7	706	101.4
After Adjusting Values for Effect of Position in Panel					
A	465	...	....	464	99.8
B	495	490	99.0	488	98.6
C	561	566	100.9	566	100.9
D	595	592	99.5	599	100.7
E	663	673	101.5	667	100.6
F	689	697	101.2	709	102.9

TABLE 2

Legibility of Block and Rounded Letters, Series C, in Different Spacings
4-Inch Black Letters on White Reflectorized (Glass Bead) Background

	Daytime Observations			Nighttime Observations		
	Legibility Distances—Feet		Percentage	Legibility Distances—Feet		Percentage
Legend	Block	Rounded	R/B	Block	Rounded	R/B
Close spacing—						
Bradford	161	162	100.6	99	105	106.1
Sargents	165	173	104.8	111	105	94.6
Carson	156	170	109.0	107	111	103.7
Average	161	168	104.3	106	107	100.9
Normal spacing—						
Bradford	193	190	98.4	117	116	99.1
Spencers	179	190	106.1	118	115	97.5
Condon	174	179	102.9	117	121	103.4
Average	182	186	102.2	117	117	100.0
Wide spacing—						
Bushrod	169	168	99.4	97	95	97.9
Slocums	196	190	96.9	116	112	96.6
Corbin	204	210	102.9	125	137	109.6
Average	189	189	100.0	113	115	101.8

One more finding remains to be mentioned briefly. Reflecting button letters in rounded style proved to be 5.3 per cent more effective by day and 10.7 per cent more effective by night than were block letters. The advantage of the rounded letters in daylight was about that found for unreflectorized letters in previous tests, but at night the advantage was greater than any found elsewhere, indicating that the rounded letters are, as expected, better suited than block letters to the use of reflector buttons.

There are many variables involved in sign design, and the combinations of these are almost infinite in number. In these tests, several of these variables were investigated within a limited range of

TABLE 3

Legibility of Block and Rounded Letters, Series B, D, and E at Normal Spacing—Daytime
4-Inch Black Letters on Painted White Background

Legend	Series	Legibility Distance—Feet Block	Rounded	Percentage R/B
Boulder	B	140	155	110.7
Coolidge	..	149	152	102.0
Progress	..	137	145	105.8
Average	..	142	151	103.3
Bridger	D	161	168	104.3
Comstock	..	220	235	106.8
Prospect	..	245	230	93.9
Average	..	209	211	101.0
Burdock	E	198	212	107.1
Crescent	..	236	257	108.9
Prescott	..	241	251	104.1
Average	..	225	240	106.7

TABLE 4

Effect of Letter Spacing on Legibility Distances, Series B and E—Daytime
Black Letters on Painted White Background

			Legibility Distances (Feet)					
Legend	Alphabet Series	Letter Style	Close Spacing	Normal Spacing	Wide Spacing	C	Ratios N	W
Edgemont	B	Block	136	149	174	91.3	100.0	116.8
Holbrook	..	....	138	149	151	92.6	100.0	101.3
Southern	..	....	128	157	163	81.5	100.0	103.8
Average			134	152	163	88.2	100.0	107.2
Eldridge	B	Rounded	136	148	162	91.9	100.0	109.5
Houghton	..	....	123	134	146	91.8	100.0	109.0
Stockton	..	....	165	146	171	113.0	100.0	117.1
Average			141	143	160	98.6	100.0	111.9
Florence	E	Block	251	269	283	93.3	100.0	105.2
Rockford	..	....	206	239	251	86.2	100.0	105.0
Thornton	..	....	220	238	245	92.4	100.0	102.9
Average			226	249	260	90.8	100.0	104.4
Ferguson	E	Rounded	229	240	260	95.4	100.0	108.3
Roseburg	..	....	184	211	234	87.2	100.0	110.9
Thompson	..	....	245	244	260	100.4	100.0	106.6
Average			219	232	251	94.4	100.0	108.2

values, holding all other factors constant. There undoubtedly are other relationships to be explored and it might prove to be the case that in some of the comparisons made, improper constants have been used and that the conclusions are seriously affected thereby.

Unfortunately, it is not possible to make more than general comparisons between the separate tests in this investigation or with the tests of others since different legends of differing inherent legibility, different observers of differing eyesight, and different techniques have been used. One variable must be taken at a time and it is not easy to tell which should be taken first. It is believed, however, that these data show the way to improving sign legibility although they are not sufficient upon which to base precise engineering specifications in all cases.

The principal conclusions reached in the tests so far made are:

TABLE 5

Effect of Types of Reflectorizing on Legibility—Night

		Legibility Distances—Feet			Ratios		
Legend	Size and Series	Black on White (Glass Bead)	White (Glass Bead) on Black	Reflector Buttons	B on W	W on B	Buttons
Roseburg	4" E	165	185	...	100	112.1	...
Ferguson	....	182	215	...	100	118.1	...
Thompson	....	191	245	...	100	128.3	...
Average		179	215	...	100	120.1	...
Brighton	8" D	376	411	363	100	109.3	96.5
Chandler	....	346	404	339	100	116.8	98.0
Erickson	....	338	379	292	100	112.1	86.4
Average		353	398	331	100	112.7	93.8

1. Rounded letters are somewhat more legible than block letters.

2. A rather wide spacing of letters is desirable.

3. Reflecting white letters on a black background are more legible by night and by day than black letters on a white reflecting background, though the signs themselves are apparently less conspicuously seen by day.

TABLE 6
Effect of Types of Reflectorizing on Legibility—Daytime

Legend	Size and Series	Legibility Distances—Feet: Black on White (Glass Bead)	White (Glass Bead) on Black	Reflector Buttons	Ratios: B on W	W on B	Buttons
Roseburg	4″ E	198	205	...	100	103.5	....
Ferguson	....	230	233	...	100	101.3	....
Thompson	....	246	259	...	100	105.3	....
Average		225	233	...	100	103.6	....
Brighton	8″ D	443	429	410	100	96.8	92.6
Chandler	....	389	436	402	100	112.1	103.3
Erickson	....	398	409	400	100	102.8	100.5
Average		410	425	404	100	103.7	98.5

TABLE 7
Legibility of Rounded Letters as Affected by Stroke Width—Night
4- and 8-Inch Series D. Black on White Reflectorized (Glass Bead) Background

Legend	Letter Height	Legibility distances—feet: Standard	First Oversize	Second Oversize	Ratios: Standard	First Oversize	Second Oversize
Blanding	4″	165	167	157	100	101.2	95.2
Oakridge	..	159	156	171	100	98.1	107.5
Republic	..	190	194	189	100	102.1	99.5
Average		171	172	172	100	100.6	100.6
Congress	8″						
Dearborn	..	337	353	357	100	104.7	105.9
Standish	..	338	366	377	100	108.3	111.5
		360	381	381	100	105.8	105.8
Average							
		345	367	372	100	106.4	107.8

Table 8
Legibility of Rounded Letters as Affected by Stroke Width—Daytime
4- and 8-inch Series D. Black on White Ground

Legend	Height Letter	Legibility distances—feet: Standard	First Oversize	Second Oversize	Ratios: Standard	First Oversize	Second Oversize
Blanding	4″	207	204	188	100	98.6	90.8
Oakridge	..	195	182	198	100	93.3	101.5
Republic	..	226	227	223	100	100.4	98.7
Average		209	204	203	100	97.6	97.1
Congress	8″	385	405	412	100	105.2	107.0
Dearborn	..	370	389	395	100	105.1	106.8
Standish	..	411	425	410	100	103.4	99.8
Average		389	406	406	100	104.4	104.4

PAPERS PRESENTED BEFORE

Committee on Road Design
American Association of State Highway Officials

November 28-30, 1944

Cincinnati, Ohio

H. C. COONS, Michigan, Chairman

D. W. LOUTZENHEISER, P.R.A., Secretary

Aerial Surveys Expedite Highway Planning

SAMUEL NELSON, Deputy Chief Engineer, Palisades Interstate Park Commission

THE Palisades Interstate Park Commission is an interstate body, established in 1900 by joint legislative acts of the States of New York and New Jersey for the purpose of preserving and protecting the mountainous lands along the west bank of the Hudson River. Since its creation the commission has acquired over 45,000 acres of land for park purposes, including the majestic Palisades of the Hudson River and the 40,000-acre Bear Mountain-Harriman Section, located in the Hudson Highlands of Rockland and Orange Counties in the State of New York, about 40 miles from the heart of the densely populated metropolitan area. (Figure A.)

Approximately six million people annually visit these park areas to enjoy their scenic beauty and to participate in healthful, out-door activities. The growing popularity of these recreational areas and the increase in patronage of resort areas in the Catskill Mountains, and vacationists en route to other State-owned parks farther to the north and west, have focused attention on the inadequacy of the existing highways passing through the Ramapo Mountains on the west side of the Hudson River. Only two main north-south routes, US 9-W and State Highway 17, are available for through traffic. Both of these carry a considerable volume of slow-moving commercial traffic and even normally are so congested on week ends that traffic is often delayed for hours.

The commission and the New York State Department of Public Works have long recognized the urgent need of a new traffic artery to relieve the existing, obsolete highways in this area, and have advocated the construction of a modern, arterial parkway extending from the New Jersey end of the George Washington

Convention Group Meetings

Papers and Discussions

Cincinnati, Ohio

1944

Published by

American Association of State Highway Officials

1220 National Press Building

WASHINGTON 4, D. C.